NOTES D'ÉTUDES

ET DE RECHERCHE

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THE COMPLEMENTARY CHANNEL

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Domestic savings and foreign capital: the complementarity channel.

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Abstract

Recent empirical work has shown that current account deficits have been associated with lower growth in developing countries while they have been associated with higher growth in developed countries. This paper shows that this can be rationalized in an environment where firms face (i) transaction costs on the capital market and (ii) complementarity between domestic and foreign sources of capital. In this case, larger current account deficits are associated with lower investment and lower growth. However, the positive relationship between current account balance and growth is dampened with lower transaction costs and eventually gets reversed.

Keywords: financial integration, borrowing constraint, growth, domestic savings.
JEL Classification: D82, E44, F36, G15, G21, O16.

Résumé

Des travaux empiriques récents ont montré que, dans les pays émergents, les déficits courants sont associés à une croissance et un investissement plus faibles. Inversement les déficits courants sont associés à une croissance et un investissement plus élevés dans les pays développés. Cet article montre que ces faits stylisés peuvent être rationalisés dans un modèle où (i) les entreprises font face à des coûts de transaction sur le marché du capital et (ii) où l'accès aux financements étrangers est complémentaire de l'accès aux financements domestiques. Dans ce cas, un déficit courant plus élevé est associé à une croissance et un investissement plus faible. Cependant cette relation positive entre croissance et balance courante s'atténue à mesure que les coûts de transactions diminuent et devient négative lorsque les coûts de transaction sur le marché du capital sont suffisamment bas.

Keywords: intégration financière, contrainte de crédit, croissance, épargne domestique.
JEL Classification: D82, E44, F36, G15, G21, O16.

Non technical abstract

The inter-temporal approach to the current account predicts that countries should run current account deficits when the domestic return to capital is larger than the international cost of capital. Countries can then profitably borrow from the rest of the world to finance domestic investment. As a result, output growth and investment should move negatively with current account balance, higher current account deficits translating into higher growth and higher investment. However several recent empirical studies have shown that data strongly rejects this prediction for emerging economies. If anything current account deficits have been associated with lower growth and lower investment. This paper is an attempt to build a theoretical framework to account for these recent empirical findings and provide a broader assessment of the macroeconomic implications of openness to foreign capital flows.

The paper makes two contributions. First it provides a simple model in which the current account position can move in the same direction as investment and growth. This model relies on two basic assumptions: (i) transaction costs on the capital market and (ii) complementarity between domestic and foreign sources of finance. When an economy benefits from a positive shock on the return to capital, macroeconomic growth always increases. However, if the growth rate of the domestic corporate sector increases more than the growth rate of the domestic financial sector, then domestic finance becomes relatively scarcer and given the complementarity between financing sources, capital inflows end up being lower. On the contrary, if the growth rate of the domestic financial sector increases more than the growth rate of the domestic corporate sector, then domestic finance becomes relatively more abundant and capital inflows end up being larger due to the complementarity between financing sources.

Second, the model shows that the case where capital inflows decrease with growth is more likely to hold when transaction costs on the capital market are sufficiently large while, the case where capital inflows increase with growth is more likely to hold when transaction costs on the capital market are sufficiently low. Identifying the case of large (resp. low) transaction costs to that of developing (resp. developed) countries, the model can therefore account for (i) the positive relationship between current account balance and growth in emerging economies. (ii) why this relationship gets dampened and reversed in developed economies.

Résumé non technique

Selon la théorie inter-temporelle du compte courant, une économie devrait connaître un déficit de son compte courant lorsque le rendement domestique du capital est supérieur au coût international du capital. Il est alors possible de se financer auprès du reste du monde de manière profitable. Un déficit du compte courant devrait donc être associé à un investissement et une croissance plus élevés. Cependant des études empiriques récentes montrent que cette prédiction est empiriquement rejetée notamment dans le cas des pays émergents. Cet article propose une explication au fait que les déficits courants soient associés à de moindres performances macroéconomiques. Plus généralement, il s'attache à développer un modèle des implications macro-économiques de l'ouverture aux flux de capitaux.

L'article est articulé autour de deux résultats principaux. D'abord, il fournit un modèle simple dans lequel le solde du compte courant peut varier dans le même sens que l'investissement et la croissance. Ce modèle s'appuie sur deux hypothèses : (i) des coûts des transactions sur le marché du capital et (ii) une relation de complémentarité entre les financements en provenance du secteur financier domestique et ceux émanant de l'étranger. Lorsque l'économie bénéficie d'un choc positif sur le rendement du capital, la croissance est toujours plus élevée. En revanche, si la croissance du secteur financier domestique augmente moins que celle du secteur des entreprises domestiques, alors les financements domestiques deviennent relativement plus rares, et les flux de capitaux en provenance de l'étranger diminuent en raison de la complémentarité entre financements domestiques et financements étrangers. Inversement si la croissance du secteur financier domestique augmente plus que celle du secteur des entreprises domestiques, alors les financements domestiques deviennent relativement plus abondants, et les flux de capitaux en provenance de l'étranger augmentent en raison de la complémentarité entre financements domestiques et financements étrangers.

Ensuite, le modèle montre que le cas où les flux de capitaux diminuent avec la croissance est plus probable lorsque les coûts de transactions sur le marché du capital sont relativement grands. Inversement le cas où les flux de capitaux augmentent avec la croissance est plus probable lorsque les coûts de transactions sur le marché du capital sont relativement faibles. En identifiant le cas de coûts de transaction élevés (resp. faibles) au cas des pays émergents (resp. développés), alors le modèle permet de comprendre (i) pourquoi la

relation entre croissance et solde du compte courant peut être positive dans les pays émergents, (ii) pourquoi cette relation positive est atténuée voire inversée dans les pays développés.

1 Introduction.

The ability to borrow resources from the rest of the world is a fundamental between open and closed economies. Open economies can finance productive investments that could not have been undertaken on the basis of domestic savings alone. In particular, an open economy tends to borrow from the rest of the world, i.e. runs a current account deficit, when the return to domestic investment exceeds the return foreign lenders ask for.[1] Therefore a negative association between current account balance on the one hand and investment and growth on the other hand should hold.[2]

However, both anecdotal evidence and a systematic empirical examination suggest a very different picture. For example, Gourinchas and Jeanne (2007) compare Madagascar to South Korea. Over 1980-2000, Madagascar invested on average 2.8% of its GDP while its current account balance was about -6% of its GDP. South Korea invested on average 32% of its GDP while its current account balance was approximately zero over the same period. Systematic evidence provided in next section goes in the same direction: current account deficits have been associated with lower growth and lower investment among developing countries.

This paper aims at providing a simple framework which can account for the positive association between current account balance on the one hand and investment and growth on the other hand. We consider an economy where entrepreneurs can borrow from domestic and foreign lenders but face credit constraints. Two basic assumptions are added. First domestic lenders are more efficient than foreign lenders in recovering their assets following a default.[3] Second, entrepreneurs face financial intermediation costs. With the first assumption, we show that the borrowing capacity from foreign lenders increases with the volume of capital borrowed from domestic lenders. Domestic lenders being relatively efficient in recovering their assets following a default, entrepreneurs' incentives to default decrease with the volume of capital they borrow from domestic lenders. Conversely foreign lenders being relatively inefficient in recovering their assets following a default,

[1] This statement holds in a risk free world. When risk is introduced, a current account deficit is run when the risk adjusted return on domestic investment is larger than the risk adjusted return foreign lenders ask for.

[2] In a world of perfect capital mobility, the return to capital should be equalized across all countries. However, investment should still be larger in countries with larger current account deficit.

[3] This is the key assumption of the paper. Its justification lies in the fact that domestic lenders are more accustomed than foreign lenders to deal with domestic entrepreneurs. Domestic lenders can therefore recover their debts more easily, i.e. at a lower cost, when an entrepreneur tries to escape its debt repayments. See Mian (2006) for an empirical investigation of this proposition. See also Guiso, Sapienza and Zingales (2004) which shows that investment is highly correlated to savings at the county level in Italy.

entrepreneurs' incentives to default increase with the volume of capital they borrow from foreign lenders. Therefore when entrepreneurs borrow a larger volume of capital from domestic lenders, foreign lenders can raise the volume of capital they lend to entrepreneurs without raising incentives to default.[4]

Due to this complementarity property, the economy attracts larger foreign capital inflows when the domestic financial system is larger. Aggregate investment is then proportionally less financed with entrepreneurs capital and more with domestic and foreign lenders capital. Hence entrepreneurs undergo larger intermediation costs and this can reduce aggregate investment if complementarity between domestic borrowing and the access to foreign capital is not sufficiently large. Given that the complementarity effect decreases with the marginal financial intermediation cost, we end up with two simple cases. If intermediation costs are sufficiently low, then complementarity is large and capital inflows increase with investment and growth. On the contrary if intermediation costs are sufficiently large, then complementarity is low and capital inflows decrease with investment and growth.[5]

Finally we investigate how the return to capital affects capital inflows and growth. While an increase in the return to capital always raises growth, its effect on capital inflows depends on how it affects the relative size of the domestic financial system. When financial intermediation costs are large, the relative size of the domestic financial system decreases and so do capital inflows. On the contrary with low financial intermediation costs, the relative size of the domestic financial system increases and so do capital inflows. Hence a positive shock on the return to capital raises growth and capital inflows -as predicted by the intertemporal approach to the current account- if and only if financial intermediation costs are sufficiently low.

Interpreting intermediation costs as an inverse proxy for financial development, the two above cases can be wrap up saying that with low financial development foreign capital inflows are associated with lower investment and growth. However, this negative relationship dampens as the economy develops financially and eventually gets reversed. This framework hence provides a simple and intuitive explanation for the

[4] There may be alternative mechanism through which the access to foreign capital may increase with domestic borrowing. For instance when the government can influence contract enforceability (see. Broner and Ventura (2006)), then contracts are more likely enforced when a larger volume of domestic capital is invested in firms. Foreign lenders can then increase their capital supply.

[5] Note that the complementarity property is a necessary condition to obtain a negative association between foreign capital inflows and growth. With substituability, a larger domestic financial system reduces both foreign capital flows and growth.

empirical results that have been developed in the recent literature on the role of foreign capital in the growth process (among others Aizenman et al. (2006), Gourinchas and Jeanne (2007) and Prasad, Rajan, and Subramanian (2007) point out a positive relationship between growth and current account balance).

This paper relates to two strands of literature. The first deals with the effect of financial openness and capital flows on domestic savings and investment. In their seminal paper, Feldstein and Horioka (1980) show that among OECD countries, the correlation between investment and domestic savings is large and hence difficult to reconcile with a view of capital being highly mobile. Rodrik (1998) argues that foreign savings cannot account for a large share of investment even in widely open countries. Aghion, Comin and Howitt (2006) point out that domestic savings can raise a country attractiveness for FDI. A number of papers have tried to determine the effect of financial integration on domestic savings and investment (Obstfeld (1998), Bosworth and Collins (1999) or Razin Sadka and Yuen (1999)). Similarly, Caballerro and Krishnamurthy (2001) focuses on the effects of exogenously given domestic and international borrowing constraints on real and financial variables. Finally Prasad, Rajan and Subramanian (2007) study the growth effects of the access to foreign capital using macro and industry level data. The contribution of this paper is here to provide a mechanism to account for a possibly positive relationship between current account and growth. Moreover the paper highlights the dampening role of financial development in this relationship.

Secondly this paper relates to the literature on the cost of capital effects of financial liberalization. Bekaert, Harvey and Lundblad (2001), Bekaert, Harvey and Lumsdaine (2002) or Blair Henry (2003) all show that financial liberalization reduces significantly the cost of capital for firms, which constitutes a powerful channel through which liberalization affects investment and growth. Kose, Prasad and Terrones (2003) show that financial integration has positive growth effects but mostly in developed countries.

The paper is organized as follows. A review of the recent empirical literature on the relationship between growth and current account balance is provided in section 2. Section 3 describes the functioning of the credit market. Section 4 derives the main result of the paper. It builds a small open economy model where entrepreneurs faces credit constraint and derives the properties of the relationship between capital inflows and growth. Conclusions are eventually drawn in section 4.

2 Stylized facts on current account balance and growth

The traditional way of thinking about the relationship between current account and growth focuses on differences between the domestic and the international returns to capital: a country ruuns a current account deficit when the domestic return to capital is larger and the international cost of capital. Such current account deficits raise investment and thereby growth. Hence current account deficits are theoretically associated with larger economic growth in as much as they reflect arbitrage opportunities.

The difficulty in testing empirically this prediction consists in obtaining a proper empirical assessment of anticipated changes in the net return to capital. This problem can be bypassed assuming that expectation errors on anticipated changes in the net return to capital are uncorrelated across countries or across time. If expectation errors are uncorrelated across countries, then countries running a current account deficit should on average benefit from a positive arbitrage opportunity. On the contrary countries running a current account surplus should on average suffer a negative arbitrage opportunity. Hence investment should be larger on average across countries running current account deficits than across countries running current account surplus.

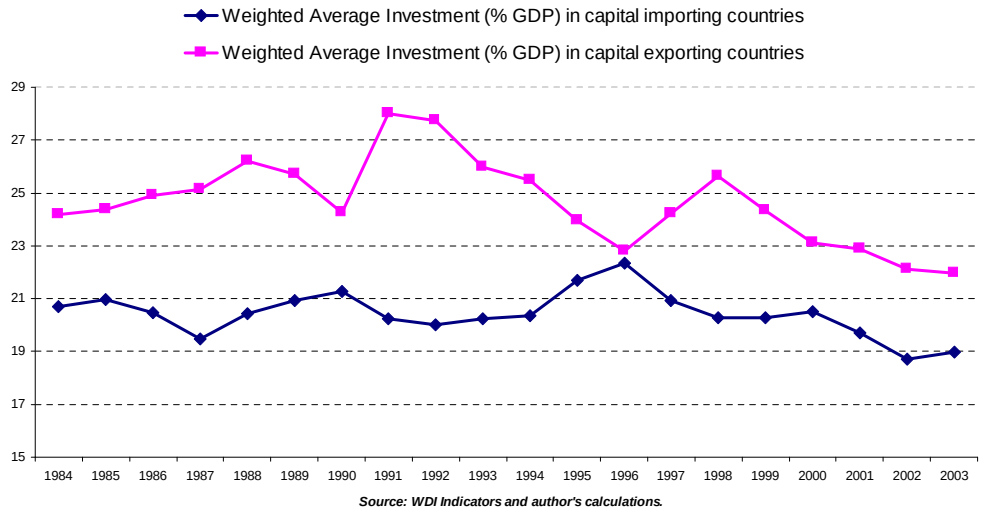

Figure 1: Average investment rate in capital importing and capital exporting countries.

Empirical evidence goes however in the opposite direction. Average investment has always been larger in

countries with a current account surplus than in countries running a current account deficit.[6] Over a twenty years period (1984-2003), the average difference in the investment to GDP ratio has been around 4 pp in favor of current account surplus countries (3 pp over the very last years). Therefore if investment -as a share of GDP- increases with the return to capital, it turns out that economies have been running a current account deficit when the return on capital was low. This conclusion is incompatible with the view that associates current account deficits with a high return on domestic capital.

Now if we consider instead that expectation errors on the net return to capital are uncorrelated across time, then the correlation between long term average current account balance and long term investment (both as a share of GDP) should be negative across countries. Considering a sufficiently long time period, expectation errors on the net return to capital should cancel out and countries with a high return should be net borrowers with high investment while countries with a low return should be net lenders with low investment.

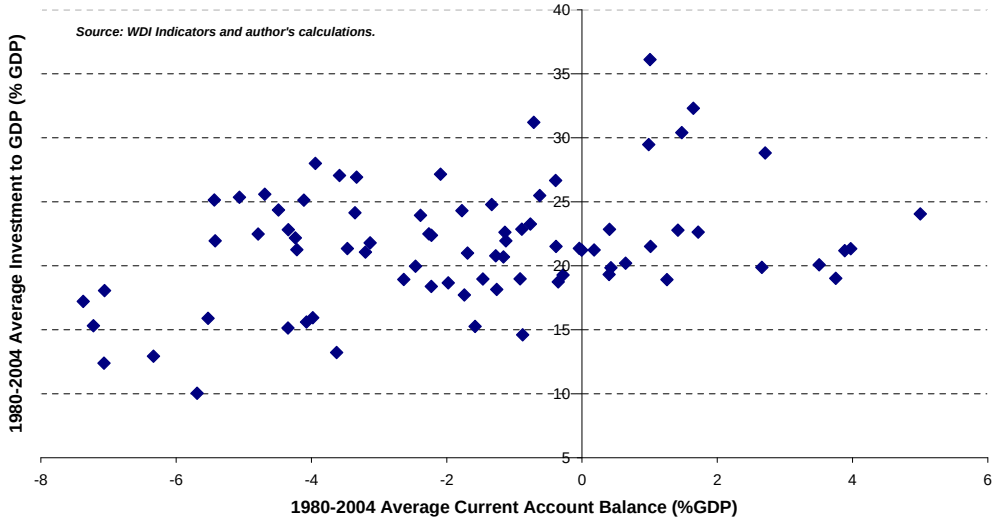

Figure 2: Average investment to GDP and average current account balance to GDP.

However as previously data do not confirm this prediction. Indeed, the cross country correlation between average current account balance and investment is, if anything, positive, thereby validating the positive association between current account balance and investment. Moreover Gourinchas and Jeanne (2007)

[6] See appendix for the list of countries in the sample of which computations are carried out. Average investment to GDP is weighted by the relative contribution of each country to the categoty it falls in.

confirm this result and extend it to the relationship between long run growth and long run current account balance showing that they are positively and not negatively associated across a large pool of developing countries. The relationship between current account balance and growth is indeed analysed in more details in Prasad, Rajan and Subramanian (2007). In particular they provide evidence on a large sample of developing countries that growth both at the macro level and at the industry level has been slower in countries which have been running larger current account deficit.

Another way to look at this question consists in comparing the average current account balance of countries with relatively high growth to that of countries with relatively low growth. To do so, based on the same sample as previously, countries are divided between those with above median GDP per capita growth and those with below median GDP per capita growth, the median being computed for the period under consideration.

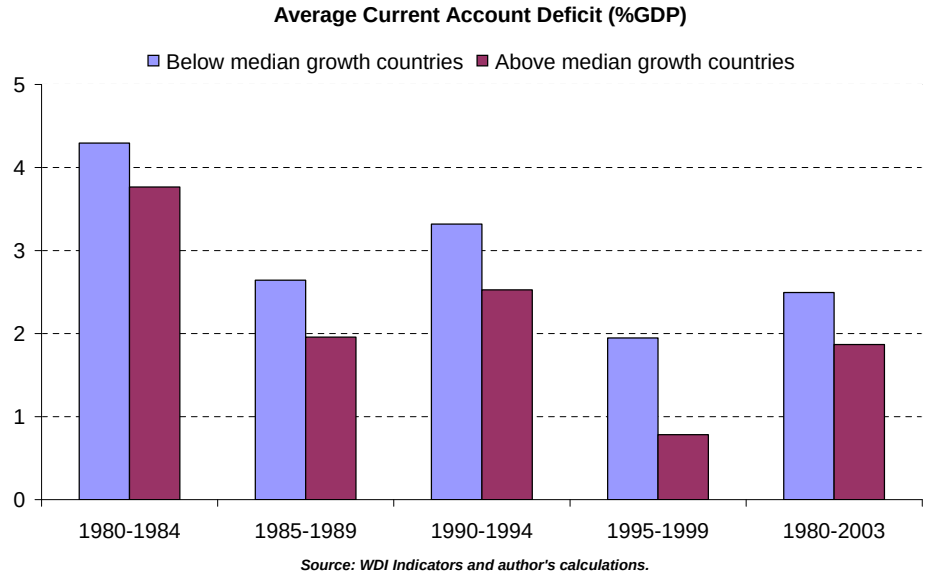

Figure 3: Current account deficits and GDP per capita growth

The current account balance has always been larger in countries with high growth compared to countries with low growth. Interestingly, the difference in average current account deficit between countries with above median GDP per capita growth seems to have increased over time. Over 1980-1984, it was about 0.4pp of GDP while over 1995-1999, it was more than 1pp of GDP, thereby indicating an increased polarization of

average current account positions across "high growth" countries and "low growth countries".

If the traditional approach to current account balance and growth cannot account for the stylized facts raised above, that begs the question of how to account for these empirical regularities. The remainder of the paper is dedicated to provide a simple framework in which capital inflows and growth are not only driven by differences in the domestic and the international return to capital. In particular heterogeneity of domestic agents -the relative number of entrepreneurs and domestic lenders- and credit constraints will be shown to be key to understand how capital inflows can be negatively related to growth.

3 The credit market

We consider an economy with entrepreneurs, domestic lenders and foreign lenders. There is a capital market where entrepreneurs can borrow from domestic and foreign lenders and where domestic lenders can borrow from foreign lenders. The capital market is imperfect as borrowers face an ex post moral hazard problem; borrowers can default strategically on their liabilities.

3.1 Entrepreneurs

Let us consider an entrepreneur with one unit of own capital (equity). It borrows μ_l from domestic lenders at a gross interest rate r_l, μ_f units of capital from foreign lenders at a gross interest rate r_f. Entrepreneurs face financial intermediation costs: when they borrow μ_l from domestic lenders (resp. μ_f from foreign lenders), they can only invest $\tau\mu_l$ (resp. $\tau\mu_f$) in their project, $1-\tau$ representing the marginal financial intermediation cost ($0 < \tau < 1$).[7] Hence the entrepreneur can invest in its project a total volume of capital equal to $1 + \tau\mu_l + \tau\mu_f$ and its profit when it does not default is

$$\pi = \left(1 + \tau\mu_l + \tau\mu_f\right) R - r_l\mu_l - r_f\mu_f \tag{1}$$

[7] In this framework, intermediation costs are assumed to be identical whether capital is borrowed from domestic or foreign sources. In a more realistic framework where intermediation costs would be larger on foreign than on domestic borrowing, the mechanism of the model would be amplified as larger capital inflows would not only raise the average intermediation cost on total capital invested. It would also raise the average intermediation cost on external capital as it is proportionally more raised from foreign sources.

R being the marginal return to capital. When the entrepreneur decides to default, it pays back only a given fraction of his liabilities but the return on investments is lower. The entrepreneur's profit in this case writes as

$$\pi_1 = \left(1 + \tau\mu_l + \tau\mu_f\right)(R - \sigma) - q_l r_l \mu_l - q_f r_f \mu_f \tag{2}$$

where q_l (resp. q_f) is the proportion of loans domestic (resp. foreign) lenders are able to recoup when the entrepreneur defaults.

We then make two assumptions. First to recover a fraction p of a loan of size L, a domestic lender (resp. foreign lender) needs to pay $c_l \ln\left(\frac{1}{1-p}\right) L$ (resp. $c_f \ln\left(\frac{1}{1-p}\right) L$). Domestic and foreign lenders therefore determine the fractions q_l and q_f as to maximize their income net of recovering costs

$$q_i = \arg\max_p p r_i \mu_i - c_i \ln\left(\frac{1}{1-p}\right)\mu_i \tag{3}$$

Second the parameters c_l and c_f are such that $c_l < \sigma\tau < c_f$. Under this assumption, when $p = 0$ the marginal cost for domestic lenders to recover their loans c_l is lower than the marginal cost $\sigma\tau$ for entrepreneurs to default. On the contrary, the marginal cost for foreign lenders to recover their loans c_f is larger than the marginal cost for entrepreneurs to default $\sigma\tau$ when $p = 0$. We can then derive the incentive compatible contracts with the following proposition.

Proposition 1 *Noting μ_l the domestic debt equity ratio, μ_f the foreign debt equity ratio for a given entrepreneur and $\varepsilon_i = c_i/\sigma$, then domestic and foreign lenders capital supply verifies the condition*

$$\mu_f \leq \frac{1 + (\tau - \varepsilon_l)\,\mu_l}{\varepsilon_f - \tau} \tag{4}$$

Proof. When an entrepreneur defaults, domestic and foreign lenders choose respectively q_l and q_f such that $(1 - q_l)\, r_l = c_l$ and $(1 - q_f)\, r_f = c_f$. Plugging these equalities in expression (2), and solving the incentive constraint $\pi \geq \pi_1$ yields condition (4). ■

The volume of capital entrepreneurs can borrow from foreign lenders increases with the volume of capital

they borrow from domestic lenders. Domestic lenders being relatively more efficient than foreign lenders in recovering their claims from entrepreneurs who default, entrepreneurs who borrow large amounts of capital from domestic lenders incur large losses if they choose to default. Hence an entrepreneur who borrows a large volume of capital from domestic lenders is less likely to default. As a result, foreign lenders can supply larger amounts of capital without destroying entrepreneurs' incentives to pay back loans.[8]

The parameter $\lambda_f = \frac{1}{\varepsilon_f - \tau}$ defines the unconditional volume of capital domestic entrepreneurs can borrow from foreign lenders. The parameter $\lambda = \frac{\tau - \varepsilon_l}{\varepsilon_f - \tau}$ defines the marginal increase in the access to foreign capital following an increase in domestic borrowing. These parameters both depend on τ. Hence financial development (in the sense of a higher τ) raises both the unconditional volume of capital entrepreneurs can borrow from abroad and the complementarity between domestic borrowing and the access to foreign capital.

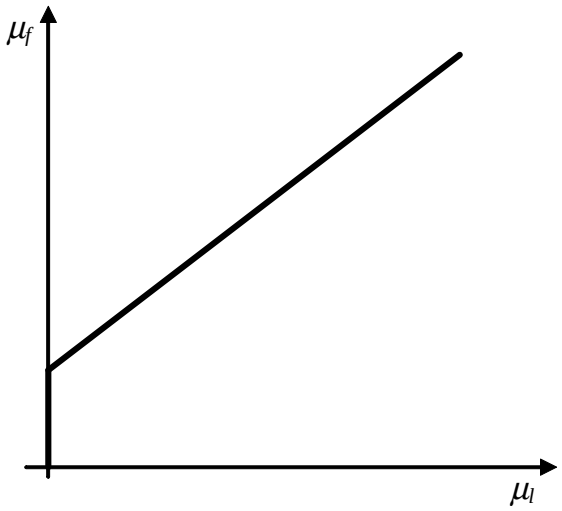

Figure 4: Entrepreneurs borrowing constraints.

3.2 Domestic lenders

Let us consider a domestic lender with one unit of own capital (equity). It borrows μ_f from domestic lenders at a gross interest rate r_f. Domestic lenders face financial intermediation costs as entrepreneurs do. Hence

[8] Appendix shows that the positive impact of domestic borrowing on the access to foreign capital does not come from the impossibility for entrepreneurs to default selectively on liabilities to domestic lenders or on liabilities to foreign lenders.

the domestic lender enjoys a profit

$$\pi_l = \left(1 + \tau\mu_f\right) r_l - \mu_f r_f \tag{5}$$

If the domestic lender decides to default then the profit it enjoys writes as

$$\pi_{l,1} = \left(1 + \tau\mu_f\right) (r_l - \sigma) - q_f \mu_f r_f \tag{6}$$

where p_f is as previously determined through the condition

$$p_f = \arg\max_p p r_f \mu_f - c_f \ln\left(\frac{1}{1-p}\right) \mu_f \tag{7}$$

Consequently, noting $\varepsilon_f = \frac{c_f}{\sigma}$, the incentive constraint for domestic lenders $\pi_l > \pi_{l,1}$ simplifies as

$$\mu_f \leq \frac{1}{\varepsilon_f - \tau} \tag{8}$$

A comparison of (4) and (8) shows that the credit constraint for domestic lenders is identical to the credit constraint for entrepreneurs when entrepreneurs do not borrow from domestic lenders.

4 The small open economy

4.1 Main assumptions

We consider a competitive economy with a single good where agents live for one period. At each period, there is a proportion $1-\phi$ of entrepreneurs ($i = e$) and a proportion ϕ of domestic lenders ($i = l$). All agents own the same initial wealth k_t at the beginning of the period t. They invest at the beginning of the period their initial wealth following the technologies they have access to (see below). At the end of the period, they reap their profits and take a consumption and saving decision. End of period t savings then constitute period beginning of period $t+1$ initial capital. Agents save a fraction s of their final wealth and consume a

fraction $1-s$.[9]

Entrepreneurs have access to a technology whose marginal return is R. They can borrow from domestic and foreign lenders to finance their investments. Domestic lenders can lend their capital to entrepreneurs and they can borrow from foreign lenders. However entrepreneurs and domestic lenders face credit constraints as described in section 3.

The timing of the model is as follows: Ex ante, entrepreneurs and domestic lenders take borrowing decisions according to the credit constraints they face and lend or invest. Domestic and foreign lenders provide capital to entrepreneurs. Ex post, output is realized and entrepreneurs and domestic lenders pay back their loans.

4.2 Entrepreneurs and domestic lenders optimal borrowing

Entrepreneurs optimal borrowing is a debt portfolio $\left(\mu_l, \mu_f\right)$ which maximizes the profit function (1) given the credit constraint (4). The program therefore writes as

$$\begin{aligned} &\max_{\mu_l,\mu_f} \left(1+\tau\mu_l+\tau\mu_f\right) R - r_l\mu_l - r_f\mu_f \\ &\text{s.t. } \mu_f \leq \lambda_f + \lambda\mu_l \end{aligned} \tag{9}$$

Proposition 2 *Assuming $r_f < \tau R$, the volume of capital an entrepreneur borrows respecitively from domestic and foreign lenders $\left(\mu_l^*, \mu_f^*\right)$ verify*

$\mu_f^* = \lambda_f + \lambda\mu_l^*$ and μ_l^* is infinite if and only if $r_l \leq \tau\left(1+\lambda\right)R - \lambda r_f$.

$\mu_f^* = \lambda_f$ and $\mu_l^* = 0$ if and only if $r_l > \tau\left(1+\lambda\right)R - \lambda r_f$.

Proof. Straightforward. ■

Entrepreneurs borrow from the most efficient source of capital. However the complementarity relationship introduces two differences compared to a standard linear program. First entrepreneurs can borrow from both sources of capital at the same time. Second entrepreneurs can possibly borrow from domestic lenders even

[9] The share of initial wealth that is consumed has no influence on the results of the model as long as it is different from one. In what follows, it is pinned down to zero as to simplify the exposition of the model.

if the interest rate on domestic loans is larger than the marginal productivity of capital. This is the case when $(\tau(1+\lambda)-1)R > \lambda r_f$. This feature is directly due to the complementarity relationship between domestic borrowing and the access to foreign capital. Borrowing from domestic lenders can be optimal, even if it generates net losses because losses on domestic loans are more than compensated by gains from the increased access to foreign capital.

Similarly, domestic lenders optimal borrowing consists in determining the volume of capital μ_f to borrow from foreign lenders which maximizes the profit function (5) given the credit constraint (8). The program of domestic lenders therefore writes as

$$\begin{aligned} &\max_{\mu_l,\mu_f} \left(1+\tau\mu_f\right) r_l - r_f\mu_f \\ &\text{s.t. } \mu_f \leq \lambda_f \end{aligned} \tag{10}$$

Proposition 3 *The optimal volume of capital a domestic lender borrows from foreign lenders μ_f^* verifies*

(i) $\mu_f^* = \lambda_f$ if and only if $r_f \leq \tau r_l$

(ii) $\mu_f^* = 0$ if and only if $r_f > \tau r_l$.

Proof. Straightforward. ■

4.3 The equilibrium of the open economy

Since entrepreneurs demand for capital from domestic lenders is infinitely large when the domestic interest rate r_l is lower than $\tau(1+\lambda)R - \lambda r_f$, and is equal to zero otherwise, the equilibrium of the domestic capital market is such that $r_l = \tau(1+\lambda)R - \lambda r_f$. If the domestic equilibrium interest rate r_l is such that $\tau r_l < r_f$, then domestic lenders do not borrow from foreign lenders. Only entrepreneurs borrow from foreign lenders. On the contrary if $\tau r_l \geq r_f$, then both domestic lenders and entrepreneurs borrow from foreign lenders. Let us focus on this case. We hence assume in what follows that

$$\tau R + \lambda(\tau R - r_f) \geq \frac{r_f}{\tau}$$

This simply amounts to assuming that the return to capital R is sufficiently large compared to the international cost of capital r_f, an assumption which is likely to hold for developing economies. Each domestic lender then borrows λ_f from foreign lenders and can therefore lend $1+\tau\lambda_f$ to entrepreneurs. Given that there are $1-\phi$ entrepreneurs and ϕ domestic lenders in the economy, each entrepreneur can then borrow $\frac{\phi}{1-\phi}(1+\tau\lambda_f)$ from domestic lenders. Since entrepreneurs borrow the maximum amount of capital from foreign lenders that the credit constraint allows, each entrepreneur borrows $\lambda_f+\lambda\frac{\phi}{1-\phi}(1+\tau\lambda_f)$ from foreign lenders. In the aggregate, the volume of capital k_f that flows in the economy from abroad therefore writes as

$$k_f=\left[\phi\lambda_f+(1-\phi)\left[\lambda_f+\frac{\phi}{1-\phi}\lambda(1+\tau\lambda_f)\right]\right]k_t$$

k_t being the total capital stock in the economy at the beginning of period t. The expression for capital inflows k_f simplifies as

$$k_f=\left[\lambda_f+\phi\lambda(1+\tau\lambda_f)\right]k_t \tag{11}$$

Total effective investment is then the sum of entrepreneurs own capital and entrepreneurs total borrowing weighted by intermediation costs. Entrepreneurs undergo intermediation costs on capital borrowed directly from foreign lenders: they can only invest a fraction τ of that capital. They also undergo intermediation costs on capital borrowed from domestic lenders: they can only invest a fraction τ of capital borrowed from domestic lenders if this is domestic lenders own capital. However they can only invest a fraction τ^2 of capital that domestic lenders have borrowed from foreign lenders as this capital is intermediated twice. Hence total investment k_i is given by

$$k_i=\left[1-\phi+\phi\tau+\tau\left[(1-\phi)\lambda_f+\tau\phi\lambda_f+\phi\lambda(1+\tau\lambda_f)\right]\right]k_t$$

which simplifies as

$$k_i=\left[(1-\phi)+\phi\tau(1+\lambda)\right](1+\tau\lambda_f)k_t \tag{12}$$

Given that entrepreneurs' technology is constant returns to scale, aggregate output y is simply the product of total effective investment and the marginal productivity of capital R

$$y = (1 + \tau\lambda_f)\left[(1-\phi) + \phi\tau\left(1+\lambda\right)\right] Rk_t \tag{13}$$

The growth rate of the economy writes as the product of the saving rate and the difference between total output and total debt repayments to foreign lenders.[10] Assuming a saving rate $s = 1$, growth g writes as

$$g = \frac{k_{t+1}}{k_t} = (1 + \tau\lambda_f)\left[(1-\phi) + \phi\left(1+\lambda\right)\tau\right] R - r_f\left[\lambda_f + \phi\lambda\left(1+\tau\lambda_f\right)\right] \tag{14}$$

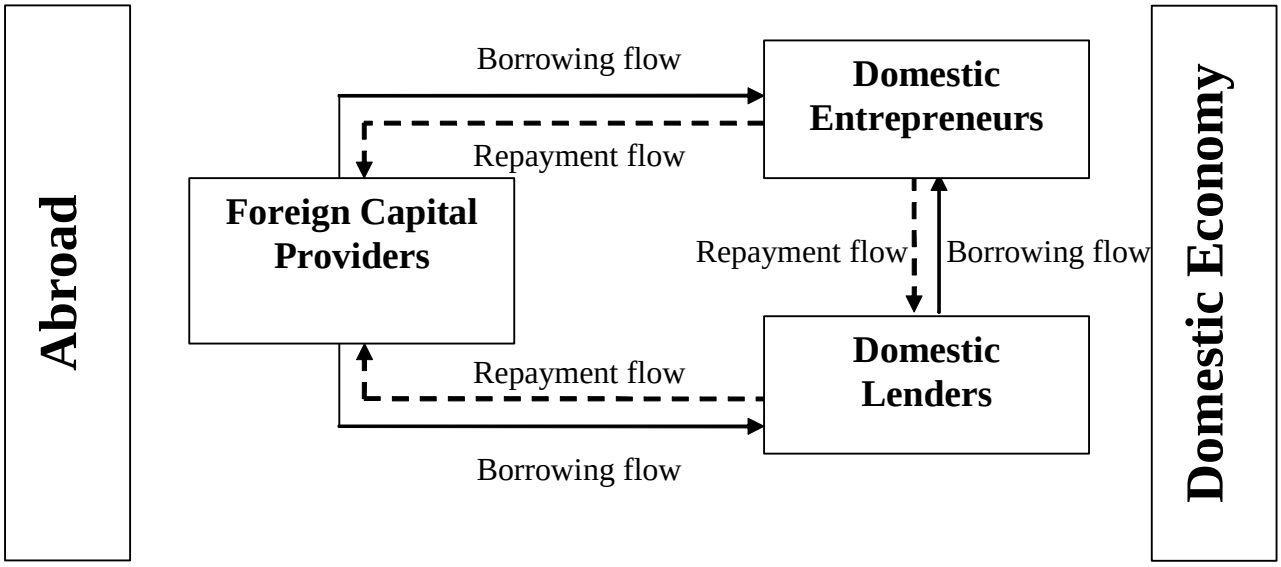

Figure 5: Flow Chart.

4.4 Investment and capital inflows

To determine how capital inflows move with investment and growth we investigate the effect of a change in the relative number ϕ of domestic lenders in the economy. First it is straightforward to note that the volume

[10] In the case where the saving rate s is diferent from one, the growth rate of the economy $g(s)$ is simply $s.g$.

of foreign capital that flows in the economy increases with the number of domestic lenders in the economy.

$$\frac{\partial k_f}{\partial \phi} = \lambda \left(1 + \tau \lambda_f\right) k_t > 0 \tag{15}$$

Due to the complementarity between domestic and foreign borrowing and given the absence of credit constraints between domestic lenders and entrepreneurs, the volume of capital entrepreneurs can borrow in the aggregate from foreign lenders increases with the number of domestic lenders. The economy is therefore able to attract a larger aggregate volume of capital from abroad when the number of domestic lenders is larger.

However the increase in capital inflows that comes out a larger number of domestic lenders does not necessarily translate into an increase in the effective volume of capital invested in the economy. As can be noted from expression (12), an increase in the number of domestic lenders ϕ prompts an increase in the aggregate volume of capital entrepreneurs invest if and only if

$$\frac{\partial k_i}{\partial \phi} = (1 + \lambda)\, \tau - 1 > 0 \tag{16}$$

Intuitively an increase in the volume of capital that is borrowed from abroad should in principle allow the economy to invest a larger volume of capital. However if domestic investment is financed proportionally with more foreign capital, the economy will bear larger intermediation costs which tends to reduce the effective volume of capital that entrepreneurs will invest. A larger volume of capital coming from abroad hence trades-off against larger intermediation costs. When the latter effect dominates the former, then an increase in net capital inflows tends to be associated with lower investment. This case is more likely when intermediation costs are large as the complementarity index λ increases with τ. With large intermediation costs, an increase in the number of domestic lenders ϕ produces a relatively small increase in capital inflows while the loss coming due to intermediation costs -a larger share of investment is financed with intermediated capital- is large. On the contrary larger net capital inflows tend to be associated with higher investment when intermediation costs are low because the loss associated with intermediation costs is small compared to the gain due to the large complementarity effect. Hence the increase in borrowing dominates the loss ude

to intermediation costs and investment is finally larger.

As can be noted from expressions (15) and (16), the complementarity relationship is crucial to derive a negative relationship between capital flows and investment. In the case where domestic and foreign lenders capital supply are substitutes in the entrepreneur borrowing constraint, then the correlation between capital inflows and investment is always positive.[11]

$$\frac{\partial k_f}{\partial \phi} < 0 \text{ and } \frac{\partial k_i}{\partial \phi} < 0$$

In the presence of substituablity between domestic and foreign capital supply, a larger number of domestic lenders ϕ raises the domestic capital supply and hence reduces capital inflows. Similarly, a larger number of domestic lenders tends to reduce investment because intermediation costs are larger as a larger share of total capital invested comes from external sources.

Proposition 4 *An increase in the volume of capital inflows raises the volume of investment in the economy if and only if*

$$\tau \geq \frac{\varepsilon_f}{\varepsilon_f + 1 - \varepsilon_l} \tag{17}$$

Proof. Given that capital inflows always increase with the number of domestic lenders, investment increases with capital inflows if and only if $\frac{\partial k_i}{\partial \phi} > 0$ which can easily be simplified as (17) ■

In the case where domestic borrowing and the access to foreign capital are substitutes, condition (17) is never satisfied as the right hand side is larger than 1. Now applying this proposition the following conclusion can be derived. In an economy where financial intermediation costs are large, i.e. τ is low, capital inflows tend to be larger when investment is lower and vice-versa. In this framework, an economy that runs a large current account deficit also suffers from low investment because the economy has to bear large financial intermediation costs to attract large capital inflows which finally translates into lower investment at the aggregate level. Hence the positive association between current account balance and investment can be

[11] The reason why investment k_i also decreases with the number of domestic lenders ϕ in the case of substituability is that $\mu < 0$ directly implies that $(1+\mu)\tau < 1$ since $0 < \tau < 1$.

accounted for in a framework where firms are confronted on the one hand to complementarity between domestic and foreign borrowing and on the other hand financial intermediation costs. The next question we need to address is whether these results can be extended to the relationship between capital inflows and growth. This is what the next section is concerned with.

4.5 Growth and capital inflows

As noted above, the volume of foreign capital that flows in the economy increases with the number of domestic lenders ϕ in the economy. However as in the case of total investment, the increase in capital inflows that comes out a larger number of domestic lenders does not necessarily translate into an increase in the growth rate of the economy. An increase in the number of domestic lenders has therefore two opposite effects on the growth rate: it raises the volume of capital that entrepreneurs can invest. However because lenders face intermediation costs, the return per unit of capital decreases with the number of domestic lenders in the economy. Growth hence increases with the number of domestic lenders when the positive effect associated with a larger volume of investment dominates the negative effect associated with a lower productivity of capital. The latter effect is larger when the intermediation cost is large, i.e. when τ is lower. The former effect is larger when the complementarity index λ between domestic and foreign borrowing is larger. Moreover the complementarity λ increases with τ. Therefore when τ is large, an increase in the number of domestic lenders produces has a relatively small negative impact on productivity while it has a large positive impact on the volume of capital that entrepreneurs can invest in their projects. A a result growth increases with the number of domestic lenders in the economy. Conversely, when τ is low, an increase in the number of domestic lenders has a relatively large negative impact on productivity on the one hand while it has a relatively small positive impact on the volume of capital that entrepreneurs can invest in their projects on the other hand. A a result growth decreases with the number of domestic lenders in the economy.

Proposition 5 *An increase in the volume of capital inflows raises the growth rate of the economy if and only if*

$$\tau \geq \frac{\varepsilon_f R - \varepsilon_l r_f}{(\varepsilon_f + 1 - \varepsilon_l) R - r_f} \tag{18}$$

Proof. Given that $\frac{\partial k_f}{\partial \phi} \geq 0$, an increase in the volume of capital inflows raises the growth rate of the economy if and only if $\frac{\partial g}{\partial \phi} \geq 0$. Using the growth expression (14) the condition $\frac{\partial g}{\partial \phi} \geq 0$ can easily be simplified as follows

$$\frac{\partial g}{\partial \phi} \geq 0 \Longleftrightarrow \lambda \geq \frac{(1-\tau)\,R}{\tau R - r_f}$$

and with simple algebra, the second inequality can be easily be written as (18). ■

Once again this result contrast with the standard setup where domestic and foreign borrowing are substitute. When domestic and foreign borrowing are substitute, then the parameter λ is negative and growth always increases with foreign capital inflows

$$\frac{\partial g}{\partial \phi} < 0 \text{ and } \frac{\partial k_f}{\partial \phi} < 0$$

The reason is fairly straightforward. When domestic and foreign borrowing are substitute, an increase in the number of domestic lenders reduces mechanically the volume of capital the economy borrows from abroad. As to growth it also always decreases with the number of entrepreneurs in the economy because under substituability, both the total volume of capital that entrepreneurs can invest and the productivity of capital decrease with the number of domestic lenders in the economy.

Two points are worth mentionning. First both investment and growth are more likely to increase with capital inflows when intermediation costs are lower. Hence the negative correlation between investment and growth on the one hand and capital inflows on the other hand is less likely to prevail in financially developed economies where financial intermediation costs are low. Conversly economies with low financial development are more likely to exhibit the puzzling situation where investment and growth happen to be larger when capital inflows are lower. A second point is worth noting. The threshold value for intermediation costs below which investment and capital inflows are positively associated is larger than the threshold value below which growth and capital inflows are positively associated. Investment can hence increase with foreign capital inflows although growth still decreases with foreign capital inflows.

4.6 The return to capital

In the previous section we have considered the distribution of capital between entrepreneurs and domestic as exogenous. We now turn to the case where the wealth distribution is endogenous and prove that the previous result on the relationship between current account balance and growth extend in this more general setting. To do we consider the same economy as previously with one simple change. Entrepreneurs' technology uses now capital and labour and workers are domestic lenders. Half agents in the economy are entrepreneurs and half are workers/domestic lenders who own one unit of labour each. Noting l the amount of labour and k the capital stock invested in a project, the output y delivered writes as

$$y = \overline{A} k^{\alpha} l^{1-\alpha}$$

where total factor productivity $\overline{A}$ increases with the ratio of aggregate capital stock invested K to aggregate volume of labour L

$$\overline{A} = A \left(\frac{K}{L} \right)^{1-\alpha}$$

Assuming that each production factor is paid according to its marginal productivity, the gross return to each unit of capital an entrepreneur invests is equal to $R = \alpha A$ and the wage rate w per unit of capital paid to workers writes as $w = (1-\alpha) A$. Let us then note k_t^e the wealth of entrepreneurs at the beginning of period t and k_t^l the wealth of workers at the beginning of period t and $a_t = k_t^e / k_t^l$.

Capital inflows at time t are the sum of domestic lenders/workers borrowing from foreign lenders and entrepreneurs borrowing from foreign lenders. The former is $k_t^l \lambda_f$. Given the complementarity in borrowing, the latter is the sum of what entrepreneurs can borrow on the basis of their own wealth $\lambda_f \ k_t^e$ and on the basis of their domestic borrowing $\lambda k_t^l (1 + \tau \lambda_f)$. Noting k_t^f the ratio of capital inflows at time t to the size of the economy we have

$$k_t^f = \frac{\lambda_f \left(k_t^e + k_t^l \right) + \lambda k_t^l (1 + \tau \lambda_f)}{k_t^e + k_t^l}$$

which simplifies as

$$k_t^f = \lambda_f + \frac{a_t}{1+a_t}\lambda\left(1+\tau\lambda_f\right) \tag{19}$$

The growth rate of the capital stock in the economy between date t and date $t+1$, g_{t+1} is then equal to the ratio of total output net total debt repayments to foreign lenders to beginning of period capital stock. This writes as

$$g_{t+1} = \frac{\left[k_t^e + \tau k_t^l + \tau\left[\lambda_f\left(k_t^e + \tau k_t^l\right) + \lambda k_t^l\left(1+\tau\lambda_f\right)\right]\right]A - r_f\left[\lambda_f\left(k_t^e + k_t^l\right) + \lambda k_t^l\left(1+\tau\lambda_f\right)\right]}{k_t^e + k_t^l}$$

Given the existence of intermediation costs, loans from domestic and foreign lenders to entrepreneurs are discounted at a rate τ. Moreover capital lent from foreign lenders to domestic lenders which domestic lenders eventually lend to entrepreneurs is discounted at a rate τ^2. Hence the growth expression ends up writing as

$$g_{t+1} = \left(1+\tau\lambda_f\right)\frac{1+\tau\left(1+\lambda\right)a_t}{1+a_t}A - r_f\left[\lambda_f + \frac{a_t}{1+a_t}\lambda\left(1+\tau\lambda_f\right)\right] \tag{20}$$

Finally the dynamics of the economy writes as follows. The profit of entrepreneurs at the end of period t, π_t^e is simply the sum of each entrepreneurs profits stemming from projects undertaken. Hence we have

$$\pi_t^e = \left(1+\tau\lambda_f\right)\left[k_t^e + \tau k_t^l\left(1+\lambda\right)\right]R - r_l\left(1+\tau\lambda_f\right)k_t^l - r_f\left[\lambda_f k_t^e + \lambda k_t^l\left(1+\tau\lambda_f\right)\right]$$

At the equilibrium of the capital market, the interest rate on loans from domestic lenders r_l is $r_l = \tau\left(1+\lambda\right)R - \lambda r_f$. As a result, the profit of entrepreneurs simplifies as

$$\pi_t^e = \left[\left(1+\tau\lambda_f\right)R - r_f\lambda_f\right]k_t^e$$

The profit of domestic lenders/workers at the end of period t, π_t^l is the sum of their capital and labor income. Capital income is the difference between entrepreneurs' debt repayments to domestic lenders $\left(1+\tau\lambda_f\right)r_l k_t^l$ and domestic lenders repayments to entrepreneurs $\lambda_f\ r_f k_t^l$, r_l being the gross interest rate on capital lent

to entrepreneurs. Labor income is simply the product of the wage rate per unit of investment w by total investment $(1+\tau\lambda_f)\left[k_t^e+\tau k_t^l(1+\lambda)\right]$. The profit of domestic lenders/workers at the end of period t, π_t^l therefore writes as

$$\pi_t^l=\left[(1+\tau\lambda_f)r_l-\lambda_f r_f\right]k_t^l+w(1+\tau\lambda_f)\left[k_t^e+\tau(1+\lambda)k_t^l\right]$$

Finally since entrepreneurs and workers/domestic lenders have the same saving rate s, the beginning of period $t+1$ capital stock k_{t+1}^i of type i agents is $k_{t+1}^i=s\pi_{t+1}^i$ $(i=\{e,l\})$. The dynamics of the economy is then summarized in the dynamics of the ratio of workers to entrepreneurs capital stock $a_t=k_t^l/k_t^e$:

$$a_{t+1}=\frac{\left[(1+\tau\lambda_f)r_l-\lambda_f r_f\right]a_t+w(1+\tau\lambda_f)\left[1+\tau(1+\lambda)a_t\right]}{(1+\tau\lambda_f)R-r_f\lambda_f} \tag{21}$$

where the equilibrium interest rate on loans from domestic lenders is $r_l=(1+\lambda)\tau R-\lambda r_f$. We can then derive the following result as to the steady state relationship between capital inflows and growth.

Proposition 6 *If the economy's steady state is non degenerate, an increase in the return to capital R always raises steady state growth but raises steady state capital inflows if and only if $(1+\lambda)\tau>1$.*

Proof. First the steady state of the economy is non degenerate if the steady state ratio of workers to entrepreneurs wealth $\overline{a}$ is nor zero nor infinite. Given the law of motion (21), the steady state ratio of workers to entrepreneurs wealth can never be equal to zero since it does fit the steady state condition $a_{t+1}=a_t$. The steady state can however by infinitely large if

$$\frac{(1+\tau\lambda_f)\left[r_l+\tau w(1+\lambda)\right]-\lambda_f r_f}{(1+\tau\lambda_f)R-r_f\lambda_f}>1$$

Simplifying this condition, we consequently focus on the case where

$$(1-\tau(1+\lambda))R>\tau(1+\lambda)w-\lambda r_f$$

Under such an assumption, the steady wealth distribution of the economy is given by

$$a = \frac{w}{R - r_l - w\tau\left(1+\lambda\right)} \tag{22}$$

An increase in the return to capital R then raises steady state growth if and only if

$$\frac{\partial g}{\partial R} = \frac{1+\tau\lambda_f}{1+a}\left[1+\tau\left(1+\lambda\right)a + \frac{\left(\tau\left(1+\lambda\right)-1\right)A - \lambda r_f}{1+a}\frac{\partial a}{\partial R}\right] > 0$$

Given expression (22) for a, this simplifies as

$$\frac{\partial g}{\partial R} = 1+\tau\lambda_f$$

Output growth g therefore always increases at the steady state with the return to capital R.

As to steady state capital inflows k_f, they increase with the return to capital R if and only

$$\frac{\partial k_f}{\partial R} = \left(\frac{a}{1+a}\right)^2 \lambda\left(1+\tau\lambda_f\right)\frac{\left(1+\lambda\right)\tau - 1}{w} > 0$$

Capital inflows hence increase at the steady state with the return to capital R if and only if $\left(1+\lambda\right)\tau > 1$.

■

Output growth always increases with the return to capital due to the increase in total factor productivity. However foreign capital inflows do not always increase with the return to capital. The reason for that is as follows:

At the steady state, an increase in the return to capital R raises both entrepreneurs' and workers' wealth. However the increase in domestic lenders/workers' wealth is larger than the increase in entrepreneurs' wealth when $\left(1+\lambda\right)\tau > 1$. On the contrary the increase in domestic lenders/workers' wealth is lower than the increase in entrepreneurs' wealth when $\left(1+\lambda\right)\tau > 1$.

Therefore when $\left(1+\lambda\right)\tau > 1$, an increase in the return to capital moves the steady state wealth distribution

towards domestic lenders/workers. Entrepreneurs can then borrow a larger volume of capital from domestic lenders. Given the complementarity between domestic and foreign borrowing, entrepreneurs can also borrow a larger volume of capital from foreign lenders and capital inflows end up being larger. Hence foreign capital inflows increase with the domestic return on capital.

On the contrary when $(1+\lambda)\tau < 1$, an increase in the return to capital shifts the steady state wealth distribution towards entrepreneurs. The volume of capital they can borrow from domestic lenders is then lower. Given the complementarity between domestic and foreign borrowing, the volume of capital entrepreneurs can borrow from foreign lenders is also lower and capital inflows end up being lower. As a result, foreign capital inflows decrease with the domestic return on capital.

The condition $(1+\lambda)\tau > 1$ is more likely to be verified when financial intermediation costs are lower, i.e. when τ is larger. Hence the pattern of foreign capital flows is consistent with the neoclassical growth model -capital inflows increase with the return to capital- in economies with low financial intermediation costs, i.e. with high financial development. On the contrary, the pattern of foreign capital flows is opposite to the pattern predicted by the neoclassical growth model in economies with high financial intermediation costs, i.e. with low financial development.

On the basis of these remarks, it appears that with low financial intermediation costs, growth and capital inflows move in the same direction, they both increase with the domestic return on capital. On the contrary, with financial intermediation costs, growth and capital inflows tend to move in opposite directions, growth increases with the domestic return on capital while capital inflows decrease with the domestic return on capital.

Hence a model with financial intermediation costs and complementarity between domestic and foreign borrowing provide a simple framework to account for the two stylized facts raised above, namely (i) a negative relationship between foreign capital flows and growth, (ii) that dampens with financial development and eventually gets reversed.

5 Conclusion

The main idea of this paper consists in showing that with imperfect capital markets, foreign capital inflows can be negatively associated with investment and growth. When imperfections stem from costly financial intermediation and complementarity between domestic and foreign sources of finance, then foreign capital inflows can move in opposite direction to investment and growth when financial intermediation costs are sufficiently large. On the contrary with low financial intermediation costs, then foreign capital inflows move in the same direction than investment and growth. This imperfect capital market framework can hence provide a intuitive accounting of recent empirical evidence on the negative relationship between current account deficits and growth.

Recent trends of uphill international capital flows can therefore be rationalized on the grounds that low income countries -which suffer from low financial development- have incentives from a growth point of view to limit current account deficits while high income countries -which benefit from high financial development- have no incentives from a growth point of view to restrict their current account deficits. A general equilibrium model with two economies and an endogenous international cost of capital is however needed to properly determine the growth implications of capital inflows. This step is accomplished in Kharroubi (2008).

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6 Appendix.

6.1 List of countries in the sample

Argentina, Australia, Austria, Belgium, Burkina Faso, Bangladesh, Bulgaria, Bahrain, Bolivia, Brazil, Botswana, Central African Republic, Canada, Switzerland, Chile, China, Cote d'Ivoire, Cameroon, Congo, Rep., Colombia, Comoros, Costa Rica, Cyprus, Germany, Denmark, Dominican Republic, Algeria, Ecuador, Egypt, Arab Rep., Spain, Finland, France, Gabon, United Kingdom, Ghana, Gambia, The, Greece, Guatemala, Hong Kong, China, Honduras, Haiti, Hungary, Indonesia, India, Ireland, Iran, Islamic Rep., Iceland, Italy, Jamaica, Jordan, Japan, Kenya, Korea, Rep., Kuwait, Sri Lanka, Luxembourg, Morocco, Madagascar, Mexico, Mali, Mauritania, Mauritius, Malawi, Malaysia, Niger, Nigeria, Nicaragua, Netherlands, Norway, New Zealand, Oman, Pakistan, Panama, Peru, Philippines, Papua New Guinea, Poland, Portugal, Paraguay, Rwanda, Saudi Arabia, Sudan, Senegal, Singapore, Sierra Leone, El Salvador, Suriname, Sweden, Syrian Arab Republic, Togo, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, United States, Venezuela, RB, South Africa, Zambia, Zimbabwe.

6.2 Credit constraints

In the microeconomic framework where we derive the credit constraints that entrepreneurs and lenders face, we have used the implicit assumption that a borrower who defaults does so for both types of liabilities, i.e. on loans from domestic lenders and loans from foreign lenders. Let us assume that the borrower can choose to default on only one type of liability. For instance the borrower could default on loans from domestic lenders and pay back loans from foreign lenders. In this case its profit writes as

$$\pi_2 = \left(1 + \tau\mu_l + \tau\mu_f\right)(R - \sigma) - q_l r_l \mu_l - r_f \mu_f$$

On the contrary if the entrepreneur decides to pay back loans from domestic lenders and default on loans from foreign lenders, then its profit writes as

$$\pi_3 = \left(1 + \tau\mu_l + \tau\mu_f\right)(R - \sigma) - r_l\mu_l - q_f r_f \mu_f$$

where q_l and q_f are determined as previously. Each type of lenders will hence provide capital to borrowers such that $\pi \geq \max\{\pi_2; \pi_3\}$ which simplifies as

$$(c_f - \tau\sigma)\,\mu_f \leq \sigma\,(1 + \tau\mu_l) \tag{23}$$

$$(c_l - \tau\sigma)\,\mu_l \leq \sigma\left(1 + \tau\mu_f\right) \tag{24}$$

Hence under the assumption $c_l < \sigma\tau < c_f$ condition (24) is always verified since the left hand side is negative while the right hand side is positive. As to condition (23) given that the left hand side is positive, it simplifies as

$$\mu_f \leq \frac{1 + \tau\mu_l}{\varepsilon_f - \tau} \tag{25}$$

with $\varepsilon_f = c_f/\sigma$ and $\varepsilon_l = c_l/\sigma$. As is clear, if (4) is verified, then (25) also holds. On the contrary if (25) holds then (4) is not necessarily verified. This means that if entrepreneurs decide not to default on liabilities to domestic lenders, then foreign lenders will accept to raise their capital supply compared to the case where entrepreneurs default concerns all liabilities. However given that entrepreneur cannot credibly commit to pay back their debts to foreign lenders, (4) will turn out to be the equilibriuum credit constraint. Moreover as is clear from (25), the property that the capital supply of foreign lenders increases with the volume of capital the entrepreneur can borrow from domestic lenders extends to the case where the entrepreneur can default selectively on its liabilities.

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